Dams Sector Crisis Management Handbook

A Guide for Owners and Operators

Developed jointly by Dams Sector-Specific Agency, Dams Sector Coordinating Council, Dams Sector Government Coordinating Council, Critical Infrastructure Partnership Advisory Council

2008

Homeland Security

List response agencies for your community and geographic region. Build relationships with these groups before an incident occurs.

Resource	Contact	Phone Number
City Law Enforcement		
County Law Enforcement		
State Law Enforcement		
Local Fire Service		
Local Joint Terrorism Task Force (JTTF)		
Local Federal Bureau of Investigation (FBI)		
FBI Weapons of Mass Destruction (WMD) Coordinator		
FBI Hotline		
State Dam Safety Office		
Downstream Dam Operator		
Upstream Dam Operator		
City Emergency Management		
County Emergency Management		
State Emergency Management		
U.S. Coast Guard		
Department of Homeland Security (DHS) Protective Security Advisor (PSA) for This State		
DHS National Infrastructure Coordinating Center (NICC)	nicc@dhs.gov	202-282-9201
State Fusion Center		

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Distribution

This 2008 *Dams Sector Crisis Management Handbook* was prepared under the auspices of the U.S. Department of Homeland Security. The *Dams Sector Security Awareness Handbook* and the *Dams Sector Protective Measures Handbook* are currently available. These materials are available on the Homeland Security Information Network (HSIN) Dams Sector Portal. The Dams Sector Portal within HSIN allows for information sharing among Federal, State, and local agencies and private sector owners and operators. For additional distribution information and access requirements for HSIN, contact dams@dhs.gov.

Notice

This material does not constitute a regulatory requirement nor is it intended to conflict, replace, or supersede existing regulatory requirements or create any enforcement standard.

For Additional Information See

Dams Sector Security Awareness Handbook
An overview of how to recognize security concerns and provide appropriate responses.

Dams Sector Protective Measures Handbook
An overview of security strategies and protective measures which might be appropriate for certain dams.

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Introduction

This handbook provides an introduction to crisis management measures for dam owners. It explains how such measures are an important component of an overall risk management program. In addition, it describes major components of crisis management and provides a template and guidelines that might be useful in developing these components for other dams.

This handbook has been written to apply across a broad range of types of dam projects. Each dam is unique because of numerous differences in project configurations, engineering details, project benefits, and potential consequences from possible damage to the dam. Therefore, selection of appropriate crisis management measures as part of a risk management program will be unique for each project.

The need for this handbook was identified by the Dams Sector Security Education Workgroup, which is composed of members from the Dams Sector Coordinating Council (SCC) and the Dams Sector Government Coordinating Council (GCC). The SCC and the GCC were established as a partnership mechanism to collaborate with the Dams Sector-Specific Agency (SSA) in sector-wide security and protection activities focused on the Dams Sector. The councils provide a forum for asset owners and operators, and their government agency counterparts, to discuss, act in concert, and monitor security issues affecting the Dams Sector.

The Homeland Security Act of 2002, Homeland Security Presidential Directive 7 (HSPD-7), and other initiatives provide the basis and framework for Department of Homeland Security (DHS) responsibilities to protect the Nation's critical infrastructure and key resources (CIKR), which include:

- Establishment of the 18 CIKR sectors;
- Identification of an SSA for each CIKR sector;
- Development of a National Infrastructure Protection Plan (NIPP);
- Establishment of the GCC and SCC partnership mechanism; and
- Development of a Sector-Specific Plan for each CIKR sector.

The Dams Sector is one of the Nation's 18 identified CIKR sectors; the SSA for the Dams Sector is DHS. Additional information about the NIPP is available on the Internet at www.dhs.gov/nipp.

The Critical Infrastructure and Key Resources Support Annex to the National Response Framework (NRF) represents a major step forward for integrating the Nation's CIKR protection mission as a key component of domestic incident management. The annex describes policies, roles and responsibilities, and the concept of operations for assessing, prioritizing, protecting, and restoring the Nation's CIKR following natural disasters, terrorist events, or other man-made or technological emergencies. The annex is available at http://www.fema.gov/pdf/emergency/nrf/nrf-support-private.pdf.

programs that make effective use of available resources. The sector security partners jointly identified security-related priorities for the Dams Sector, which include, among other things, the need for developing mechanisms for the communication of security issues among member organizations. This handbook is one outcome of that process.

The Dams Sector is comprised of the assets, systems, networks, and functions related to dam projects, navigation locks, levees, hurricane barriers, mine tailings impoundments, or other similar water retention and/or control facilities. Dam projects are complex facilities that typically include water impoundment or control structures, reservoirs, spillways, outlet works, powerhouses, and canals or aqueducts. In some cases, navigation locks are also part of the dam project.

Target Audience
This handbook has been prepared for owners and operators of dams, regardless of dam size or type.

Dams are a vital part of the Nation's infrastructure and are among its key resources. Dams provide a range of economic, environmental, and social benefits, including irrigation, electric power generation, "black start" capabilities[1], water storage, recreation, navigation, flood mitigation, sediment/hazardous materials control, and impoundment of mine tailings.

The benefits of dams are countered by the risks they present. In the event of a dam failure, the volume of the water stored, even behind a small dam, is capable of causing loss of life and significant property damage. Dams may fail for one or a combination of the following reasons:

- Overtopping caused by floods;
- Structural failure;
- Foundation failure;
- Piping and internal erosion;
- Inadequate maintenance;
- Operational errors; and
- Deliberate man-made actions.

While the final topic—the potential for deliberate man-made actions—was a catalyst for development of this handbook, the crisis management measures described herein are broadly applicable to almost any type of natural or man-made incident.

This Crisis Management Handbook is intended to provide information about planning and response measures that might be used to prevent dam failures and to minimize consequences of damage or failure. Section 1 provides an overview of the Dams Sector; Section 2 describes how crisis management is a component of an overall risk management program; and Section 3 briefly describes the major components of a crisis management program. Sections 4 through 7 provide more detail about these components: emergency action plans, recovery plans, continuity plans, and exercises. Appendix A provides a template that might be used for developing emergency action plans and Appendix B offers content guidelines for recovery plans. Guidelines that could be helpful in developing continuity plans and exercises are provided in Appendix C and Appendix D, respectively. Appendix E describes the types of incidents that could spur the development of emergency action plans, recovery plans, and continuity plans and the exercises designed to test those plans. Appendices F and G list the membership of the Dams Sector Coordinating Council and Government Coordinating Council, respectively. Appendix H lists the acronyms used, and Appendix I describes the sources used in preparing the handbook.

1 A black start is the process of restoring a power station to operation after a wide-area power outage without assistance from the electrical system. Some generating plants using steam turbines require up to 10% of their capacity for this restart. Such a large standby capacity cannot economically be provided at each location; such black-start power must be provided over transmission lines from other sources. Since hydroelectric power stations need little power to restart, they can be used as power sources for restart of other types of power generation.

Section 1: Sector Overview

The Nation has more than 100,000 dams. Of this number, about 82,000 are listed in the National Inventory of Dams (NID), which generally includes dams over 25 feet in height or reservoirs having more than 50 acre-feet in storage capacity. In the NID, the downstream hazard potential (e.g., the amount of risk or damage a dam can pose due to failure or negligent operation) is classified as high, significant, or low. In the current NID database, about 12,000 dams are classified as high-hazard potential from a dam safety perspective.

Dams can have any of a number of purposes including: irrigation, water supply, electric power generation, flood control/flood damage reduction (hereafter, flood control), storm surge protection, navigation, water transport, recreation, or control of sediments, mine tailings or hazardous materials. The benefits derived from dams are countered by the risks they can present.

In the event of a dam failure, uncontrolled release of the water stored behind even a small dam is capable of causing loss of life and great property damage. For some dams, failure has the potential to cause massive immediate casualties as well as severe long-term consequences. Even if damage to a dam does not cause it to fail, but only prevents it from operating as intended, there could be significant economic impacts for the dam owner, for the surrounding community, the region, or the entire Nation.

Certain characteristics of dams make them an unusually difficult type of asset to protect. While the critical assets in many other sectors are small or concentrated and can be contained within buildings, dams are very large, most components are not within buildings, dams are often in remote locations, and they can be approached via either land or water, or even by air. These factors pose especially difficult problems in controlling access to dams. In addition, certain Federal agencies and Federal Energy Regulatory Commission (FERC) licensees are required to provide public access to certain portions of the dam project.

Because of the combination of benefits that our Nation derives from dams, the potential consequences if a dam is damaged, and the difficulties in fully protecting dams, they can be an inviting target for potential aggressors who want to harm people or inflict damage on our country. The other handbooks in this series discuss security awareness and strategies and measures to protect dams. This handbook addresses situations where damage or failure has occurred. It identifies planning measures that should occur before such an incident, and emergency response measures that should occur during and immediately after the incident.

Section 2: Risk Management

Risk management is discussed in the *Dams Sector Protective Measures Handbook*. There, the discussion is focused on using risk management to identify appropriate protective strategies and measures as part of a cost-effective plan to protect the dam and prevent or minimize the potential for a successful attack.

However, there will always be some potential that terrorists could damage a dam, or that other types of hazards could cause damage. Therefore, any comprehensive risk management program must also consider what happens if the dam is damaged, if dam failure is imminent, or if the dam has already failed, either partially or completely. The objective in such cases is to limit consequences by containing the damage and preventing failure, and by minimizing the safety and economic impacts caused by the damage or failure. These issues can all be addressed as part of a crisis management program.

Section 3: Crisis Management Programs

In a broad sense, crisis management consists of planning for and responding to any emergency incidents that might occur. There are many publications and websites that address crisis management, and cover a broad range of topics, such as corporate financial emergencies, or public relations responses to product liability situations. While these might be valid components of a corporate crisis management program, this handbook is focused more on physical damage to or failure of dams, and the resulting impacts on human safety and damage to infrastructure.

Given this somewhat limited scope, and the focus on the Dams Sector, the crisis management program presented in this handbook consists of four major components:

- Emergency Action Plans;
- Recovery Plans;
- Continuity Plans; and
- Exercises.

Each of these components is discussed here briefly, and in more detail in the following sections of this handbook.

Emergency Action Plans

Dam safety programs have long relied on emergency action plans to guide response in critical situations. The objectives of these plans are to mobilize a pre-planned response to prevent uncontrolled release of water from the dam, and to initiate community actions to maintain public safety in case of such a release.

Recovery Plans

In addition to the immediate safety issues addressed in the emergency action plan, damage to or failure of a dam can have longer term economic impacts. These will certainly impact the dam owner, but might also have wider impacts on the community, other industries, or even regional or national economies. Therefore, rapid restoration of dam functions might be necessary to help minimize such impacts. Recovery plans can be used to help prepare for quick repair of damage. Recovery plans might address both short-term repairs to partially restore project functions and long-term repairs to fully restore the project.

Continuity Plans

It might be necessary to continue dam operations during the absence of several key personnel. Continuity planning can be used to identify personnel with necessary skill sets and to define shifts of roles and responsibilities to respond to the major absence of personnel.

Exercises

While planning is essential for effective crisis management, to be more fully prepared it is necessary to conduct periodic exercises testing implementation of those plans. Exercises will raise the general awareness of potential crisis situations. They will ensure that key staff members are familiar with the plans and understand their roles and expected actions. In addition, exercises can help identify shortcomings in the plans, leading to possible improvements.

Section 4: Emergency Action Plans

Emergency Action Plans (EAPs) are intended to guide owners and operators in the prevention, response, and mitigation of impending serious incidents and minimize the ensuing life safety consequences and property damage. EAPs include notification lists to mobilize resources to prevent imminent failures during emergency situations and to communicate appropriate danger warnings to local authorities and to the public. They might also address a variety of preparedness issues such as alternative communications systems or emergency supplies and equipment. EAPs must be site-specific because conditions are unique at each dam and downstream of that dam.

The Interagency Committee on Dam Safety has established *Federal Guidelines for Dam Safety*. One portion of these guidelines is *Emergency Action Planning for Dam Owners* (FEMA 64), published by the Federal Emergency Management Agency (FEMA). Much of the content in this section parallels those guidelines. In addition to this section, Appendix A provides a template that can be used for development of an EAP. That appendix also parallels much of the "suggested EAP format" presented in FEMA 64. For more detail, see FEMA 64, which can be obtained from FEMA in print or on CD, and viewed online at http://www.fema.gov/plan/prevent/damfailure/fema64.shtm.

Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams (FEMA 333) is used in conjunction with FEMA 64 to define the types of dams for which an EAP should be developed. In addition to the Federal Guidelines, the States regulate dam safety. Each State establishes guidelines, which might include requirements for EAPs. FEMA has addressed this in *Emergency Action Planning for State-Regulated High Hazard Potential Dams* (FEMA 608).

The dam owner is responsible for the development of the EAP; however, it must be done in coordination with those agencies having emergency management responsibilities at the State and local levels. The dam owner must also ensure that the EAP conforms to any applicable State or Federal requirements. Emergency management agencies will use the information in a dam owner's EAP to facilitate the implementation of their responsibilities. State and local emergency management authorities will generally have some type of plan in place, either a local emergency operations plan or a warning and evacuation plan.

Basic Elements of an EAP

- **Notification Flowchart.** A notification flowchart shows who is to be notified, by whom, and in what priority. The information in the notification flowchart is necessary for the timely notification of persons responsible for taking emergency actions. The list of contacts might depend on the severity of the emergency. Within the dam owner's organization, the notification list should include at least representatives from project operations, engineering, and management. In addition to the internal list, the notification flowchart should include external agencies such as the State dam safety official, the local emergency management agency, and local law enforcement.

- **Emergency Detection, Evaluation, and Classification.** It is crucial to provide early detection and timely evaluation of any situation that requires an emergency action. A proper evaluation will help ensure that the appropriate course of action is taken. The EAP should include guidelines on classifying the emergency as non-failure concern, potential failure, or imminent failure. This classification will determine which notification list should be used and will indicate different types of response to the emergency.

  To assist decision makers in making a proper classification, the plan could include descriptions of severity levels for various types of events such as flooding, embankment cracks, unexpected seepage, or unusual instrumentation readings. These descriptions will assist the initial observer in taking the correct initial actions.

- **Responsibilities.** A determination of responsibility for EAP-related tasks must be made during the development of the plan. Dam owners are responsible for developing and implementing the EAP, and the plan must identify individual responsibilities to ensure effective, timely action. State and local emergency management officials having statutory obligations are responsible for warning and evacuation within affected areas. Within the dam owner's organization it should be clear who must make the initial notifications, who is responsible for declaring the emergency and the level of response, and who is in charge of the various aspects of the response.

- **Preparedness.** Preparedness refers to actions to be taken before an emergency to prevent or alleviate the effects of a dam failure or large operational releases and to facilitate the response to emergencies. Preparedness can also refer to actions taken before other types of emergency situations that might not involve large releases of water. This portion of the EAP should include a set of pre-planned actions to facilitate response to various types of emergency situations. This might include actions such as lowering the reservoir level in response to embankment settlement or excessive seepage, or placing plastic sheeting or other erosion-resistant material if overtopping of the embankment seems imminent. Preparedness should also include identifying and ensuring the availability of materials, equipment, and personnel needed for an emergency response. This might be accomplished by simply compiling a list of local suppliers and contractors, or it might entail actual stockpiling of certain materials.

- **Inundation Maps.** Inundation maps are used by the dam owner and emergency management officials to facilitate timely notification and evacuation of areas affected by a dam failure. These maps greatly facilitate notification by graphically displaying areas expected to be flooded and showing travel times for wave front and flood peaks at critical locations. The traditional hardcopy maps are being reproduced in digital formats to facilitate their use with Geographic Information Systems (GIS).

- **Appendices.** Appendices can be used to provide information that supports and supplements the material used in the development and implementation of the EAP. An appendix might be used to provide supplemental information that would be useful during an emergency situation. Examples are sources of equipment or materials, names and contact information for technical support personnel, or copies of contingency agreements with other organizations or service providers.

Coordination

Development of an EAP should be coordinated with all entities, jurisdictions, and agencies that would be affected by a dam failure or that have statutory responsibilities for warning, evacuation, and post-flood actions. Coordination will provide opportunities for discussions to identify the order in which public officials would be notified, backup personnel, alternate means of communication, and special procedures for nighttime, holidays, and weekends. Coordination will also help clarify responsibilities among the various responding organizations.

Communications

Reliable communications are essential during emergency situations to quickly exchange critical information among key individuals and organizations. The possibility of unreliable primary communication systems in times of emergency should be addressed during development of the EAP. Previous catastrophes have demonstrated that normal communications systems are unreliable during such events. It might be necessary to provide back-up communications systems for use during emergencies. Such systems should be developed and regularly tested prior to an emergency.

Evacuation

Evacuation planning and implementation are the responsibility of State and local officials. The dam owner should not usurp that responsibility; however, there may be situations where recreational facilities, campgrounds, or residences are located below a dam where the dam owner could provide a more timely warning. In such cases, the dam owner should coordinate with local emergency management officials to determine who will warn these people and in what priority.

Security Provisions

Since the terrorist attacks on September 11, 2001, infrastructure security has received much greater attention. The Department of Homeland Security has issued a National Infrastructure Protection Plan and a Dams Sector-Specific Plan.

Most larger dams now have some type of security plan (SP) in place, and these plans should be coordinated with the EAP. Because of the areas of potential overlap between the SP and the EAP, an appropriate security representative should be involved in development of the EAP.

Security Plans

This handbook uses the term security plan when referring to a plan for a specific dam project. Various organizations within the Dams Sector might use the terms site security plan or site-specific security plan to refer to such a document, and might instead use the term security plan to refer to an overall organizational plan. For more information about security plans, see the Dams Sector Protective Measures Handbook.

One area of interest in both the SP and the EAP is that a security incident could result in damage to a dam, possibly even dam failure. In such a case, the law enforcement agencies would have the added responsibility of investigating the incident to identify and apprehend the perpetrators. This could complicate the incident command authorities among local responders and potentially interfere with emergency actions planned by the dam owner.

One possibility of attack is on the cyber systems that are used to operate many dam projects. An aggressor could attempt to disable such systems or even hijack them to intentionally operate the dam improperly, in order to cause damage. Dam safety incidents caused by cyber attack should be considered during development of the EAP.

If a dam safety incident is caused by a security incident, the dam site might remain dangerous because the perpetrators are still in the area and may attempt to harm the incident responders. Such intentions have been demonstrated by terrorists at previous bombing locations within and outside of the United States. Any emergency situation (even if not caused by an attack) could be an especially sensitive time and the EAP should address necessary site security actions during these situations.

Declaring and Terminating the Emergency

The dam owner is usually responsible for making decisions that an emergency condition exists or no longer exists at the dam or that the level of the emergency has changed. The EAP should clearly designate the individual responsible for those decisions. State or local emergency management officials are responsible for initiation and termination of the evacuation or disaster response activities. Those parts of the emergency are usually managed in accordance with the National Incident Management System. The dam owner and State and local officials should agree on when it is appropriate to terminate an emergency.

Post-Emergency Evaluation

Following an emergency, all participants should participate in a review that identifies:

- Events occurring before, during, and following the emergency;
- Significant actions taken by each participant, and possible improvements for future emergencies; and
- Strengths and deficiencies found in procedures, materials, equipment, staffing levels, and leadership.

Maintaining an EAP

Without periodic maintenance, the EAP will become out-dated and lose its effectiveness. Regular exercises and periodic reviews of the EAP should be conducted to assess its workability and efficiency, identify weak areas, and recommend revisions. It might be necessary to frequently revise an EAP to reflect changes in personnel of various organizations and changes in communications systems. There should be a periodic—typically done on an annual basis—review and updating of telephone numbers and personnel included in the notification flowchart. The EAP review should identify any changes to the dam and/or floodplain that might affect the information on the inundation maps. Changes to the maps should be made as soon as practical and noted in the EAP. Each new revision of an EAP should be identified with a revision number and date to ensure the latest plan is being used. Scheduled revisions can also coincide with informal meetings with appropriate emergency management agencies to ensure they are familiar with and understand the EAP.

Sensitive Information

Since EAPs often receive wide distribution, it might be necessary to exclude sensitive information from some copies. Necessary but sensitive information could be included in the EAP as a supplement or as another appendix. Distribution of this portion could be limited to those individuals or agencies with a specific need to know.

Section 5: Recovery Plans

Certain dam projects, especially some large Federal dams, provide a wide range of benefits to a broad community. These can include economic, environmental, and social benefits, including irrigation, electric power generation, "black start" capabilities, water storage, recreation, navigation, flood mitigation, and control of sediment/hazardous materials and mine tailings. Disruption of such projects for extended periods could have devastating economic impacts regionally or even nationally. Even if smaller private dams might not provide the same level of regional benefits, there is still the potential for extensive impacts on local communities, as well as the financial impacts on the dam owner.

Recent failures of the I-35 bridge in Minneapolis and the Taum Sauk Reservoir in Missouri are reminders that aging infrastructure is always at risk for unexpected failures. The attention given to infrastructure protection since September 11, 2001 has also made it evident that it is impossible to fully protect everything. Security plans, emergency action plans, and dam safety programs are intended to reduce the chances of damage and to limit the immediate consequences if failure does occur. Despite sound design, proper operation, and excellent emergency planning, a full or partial dam failure remains a real possibility.

In some Federal agencies, the increased emphasis on infrastructure protection has drawn additional attention to the need for recovery plans (RP) in case of such failures. Restoration of communities after widespread disasters is the responsibility of other agencies, such as FEMA. Therefore, the focus of RPs has been on restoring just the dam project to a functional condition. Dam owners should consider the need for a RP as part of the risk management process. It would be advantageous to develop a RP to help speed repair or reconstruction of a dam after damage has occurred.

Recovery Plans

Various organizations within the Dams Sector might use the term recovery plan or a similar one such as rapid recovery plan to refer to the same type of document. Some might include the equivalent of a recovery plan as a section of another document, such as an emergency action plan. This handbook uses the term recovery plan as a generic, encompassing term to refer to any of these documents.

The RP should address longer-term recovery, while also focusing on short-term response that begins immediately after an incident, to restore project function as soon as possible. Since it is not possible to know the type of damage that might occur, the RP should be general enough to be useful for recovery from any type of damage, regardless of cause. Since these plans will be fairly general, it might be possible to develop a single plan applicable to a group of dams with similar components. The same approach might be possible for owners and operators of multiple projects on the same river system. When multiple-project RPs are used, any issues unique to an individual dam could be included in a separate appendix.

RP Objectives

The objectives of developing and periodically updating the RP are to:

- Minimize the extent of damage progression;
- Restore project function, beginning just after initial response;
- Minimize economic losses through quick restoration of function; and
- Address all types of potential hazards (natural, accidental, intentional).

RP Contents

The RP should make extensive references to specific content of the project EAP. This will minimize redundancy of information, make the plan simpler, and eliminate contradictory information. The Federal Energy Regulatory Commission (FERC) and the U.S. Army Corps of Engineers have developed guidelines for the content of RPs; following is a summary of those guidelines. Appendix B contains more detailed guidelines for recovery plan content.

The RP should address each critical component of the dam. The team developing the plan should identify the likely hazards and predict the type and magnitude of damage from those hazards. Based on that probable damage, there should be an order of magnitude estimate of the direct and indirect consequences. The team should develop a list of options to minimize consequences—either by reducing initial damage, limiting progression of the damage, or reducing the time needed to recover from the damage. Considering the magnitude of the consequences, the team should recommend one of those options. This process can be fairly simple; it does not necessarily require lengthy evaluations.

Results of this RP development effort should be consolidated into a list of recommended actions that might include procurement, stockpiling, on-the-shelf designs, or general preparedness actions such as identifying local equipment repair contractors, suppliers of key materials or equipment, providers of rental equipment or heavy transport, etc. Selection of the recommended actions might be dependent on the rapid availability of materials and equipment, and on potential staging areas.

In addition to physical repair/replacement/reconstruction, the RP should address issues such as communications and the basic logistics of the response. Reconstruction might require coordination with local authorities and regulatory agencies. To facilitate a quick response, it might be necessary to streamline internal authorities for procurement or contracting. Recovery will also likely require rapid access to key information such as maps, drawings and specifications, and original design documents; this information or references to where it can be found should be included in the RP.

Many projects are becoming more highly automated, relying on automatic computerized control systems, or on remote operation and monitoring via communications links. The RP should address possible loss of project function caused by interruption of communications links or by cyber attacks that render the automated control system inoperable.

Just as for other types of plans, such as EAPs, the RP should address training of appropriate personnel, and periodic exercises simulating RP implementation. There should also be a requirement for periodic updating of the RP.

Response Coordination

In the event of any major damage to a dam or to other infrastructure, multiple agencies could have significant roles in the initial response to the incident. This involvement might extend into the recovery phase for restoring project function.

Law enforcement agencies might be interested in preserving the site in the post-incident condition to facilitate criminal forensic investigations. If there has been a release of hazardous materials, there might be extensive long-term clean-up activities involving Federal and State environmental and health and safety agencies. If extensive project reconstruction is required, there may be a need to obtain approvals from several Federal and State permitting agencies. The required inter-agency coordination and the conflicting priorities of the agencies could complicate the recovery process. The RP should address these possible conflicts to the extent possible.

Financial Information

Major recovery activities are dependent on available funding. For the common types of project components, the RP should include tables that list the types of damage that might be expected, followed by various repair/replacement options to restore full or partial function, and probable time and cost for those options. These tables can provide a quick reference to assist decision makers during the tense post-incident period when important decisions must be made quickly.

Sensitive Information

For RPs to be useful, they need to be disseminated and easily available in case of an incident. However, development of a RP might require use of sensitive information such as specific vulnerabilities and potential consequences. Therefore, sensitive material should be kept separate from the portion of the RP that contains recommendations and courses of action.

Coordination with Other Plans

Content of RPs should be coordinated with existing SPs and EAPs to minimize redundant content in multiple plans. Where SPs and EAPs already contain information that is pertinent to a RP, it is generally better to reference those plans rather than repeat the same information in multiple plans. This will make the RPs simpler to develop, easier to maintain, and easier to read; it will also help prevent inconsistencies among the plans.

Section 6: Continuity Plans

Continuity planning helps facilitate the performance of an organization's essential functions during any situation that may disrupt normal operations. The continuity plan (CP) can encompass a wide range of topics such as leadership devolution, physical relocation of worksites, data preservation, and virulent disease. Organizations often address these topics and others as components of a continuity program. While discussing some of these broader aspects of continuity planning, this handbook is focused primarily on those issues that affect continued safe operation of a dam.

Many resources provide information about continuity programs. FEMA, for example, provides a Continuity of Operations Programs website at http://www.fema.gov/government/coop/index.shtm. The site provides access to online training on various aspects of continuity planning.

Continuity Plans

Continuity of operations (COOP) is a term in wide use. COOP is sometimes used to refer to an entire continuity program, covering all the interrelated aspects of continuity, and it is often used to refer to business continuity for an organization in the absence of key personnel. This handbook uses the simpler term continuity plan and uses it primarily with respect to continued safe operation of a dam.

Previous sections of this handbook addressed some aspects of continuity planning. EAPs and RPs can be considered as plans that help minimize disruptions to dam operations. Those aspects of continuity are not repeated in this section.

The following elements could be part of a continuity plan that focuses on safe operation of infrastructure in the Dams Sector; they might be broken into separate plans or part of an overall continuity program:

- Identification of essential functions;
- Interoperable communications;
- Delegations of authority;
- Alternate facilities;
- Vital records;
- Human capital; and
- Computer disruptions.

Identification of Essential Functions

Given the limited scope of the CP discussion in this handbook, essential functions and the essential personnel to carry out the functions are primarily those related to the safe storage or release of water. These functions and personnel might include:

- Controls and systems that open or close gates and valves;
- Personnel who manipulate those systems and controls;
- Personnel who decide when and how much to adjust release of water;
- Dam safety engineers authorized to make decisions on the safety of the dam;
- Collection of data that forms the basis of such decisions; and
- Communication between those operating the controls and those deciding on releases.

Interoperable Communications

Continuity of communications could become an issue during a crisis for a number of reasons. Phone systems (land line and cell) have occasionally experienced various degrees of disruption and disruptions have been even more prevalent during certain emergency situations. The crisis-related relocation of certain functions to alternate facilities can contribute to disruptions in communications systems and computer networks at a time when reliable communication is most needed. CPs should focus on maintaining critical communication capabilities and what to do when that is not possible.

Delegations of Authority

Certain types of emergency situations might result in the temporary or permanent loss or incapacitation of key personnel. This could also result in loss of communications between key personnel and others in the organization. CPs should clarify what decision-making authority will be transferred in various circumstances. For example, if communications with the chief hydrologist are disrupted, will an on-site supervisor be expected to open gates after a heavy rain? It is also necessary to clarify, prior to an actual event, who has authority to commit resources or to sign emergency contracts.

Alternate Facilities

Some CPs address relocation of essential functions if the primary location has been disrupted. In the Dams Sector, there is no possibility of relocation of the actual dam infrastructure, but relocation might apply to some of the functions that support on-site operations.

Vital Records

At a minimum, vital records might consist of reservoir levels, stream-flow data upstream and downstream of a dam, expected near-term inflows, and release rates for various gate positions. All of this information is critical to maintaining safe water levels in the reservoir and downstream. There are a number of ways such data might become unavailable: computer network malfunctions, loss of communications, sensor failures, and disruption in National Weather Service systems. CPs should focus on methods to maintain access to such information and alternatives when information is not available.

Human Capital

Any organization is dependent upon its staff for successful operation. CPs should describe how to maintain essential functions in case of serious disruption to staff. One source of disruption that has received increasing attention during the last several years is pandemic influenza. Some planning assumptions project that up to 20 percent of the workforce could become ill, and up to 40 percent might be absent from work due to illness or fear of infection. Most organizations would have great difficulty performing any functions with absentee rates of that magnitude if they persist for even a few days.

Planning should identify the staff needed to support essential functions; this should include the number of people and the skills required. These requirements should be matched against potential availability of others within the organization who might be able to fill in during emergency situations. It might even be necessary to develop plans for use of temporary staff from outside the organization. Examples of this are the mutual aid agreements that are common in the fire fighting community and the contracting for line crews after extensive electrical power outages due to severe storms. Appendix C1 presents a matrix that outlines the types of actions that should be identified as part of pandemic preparedness.

Computer Disruptions

Disruption of an organization's information technology (IT) systems might be considered to belong within the above discussions on interoperable communications, alternate facilities, or vital records. It might also be appropriate to consider it as an additional, separate category. In the modern automated workplace, disruption of the IT system could bring any organization to a standstill or lead to a dangerous lack of control over sensitive records or over physical processes (e.g., operational control over dam releases or power generation).

The United States Computer Emergency Readiness Team (US-CERT) is a partnership between the Department of Homeland Security and the public and private sectors. It was established in 2003 to protect the Nation's Internet infrastructure. It coordinates defense against and response to cyber attacks across the Nation. The US-CERT website (www.us-cert.gov) provides extensive information related to cybersecurity.

Considering the potential serious consequences of an IT disruption, it is important that this topic be specifically addressed during continuity planning. Content guidelines for a computer incident response plan are provided in Appendix C2.

Section 7: Exercises

Emergency incidents at dams and/or dam failures are not common events. Therefore, training and exercises are necessary to maintain operational readiness, timeliness, and responsiveness.

Exercises are one of the topics addressed in FEMA 64, *Emergency Action Planning for Dam Owners,* and DHS has also developed an exercise program. The FEMA 64 guidelines emphasize that dam owners should exercise their EAPs to promote emergency preparedness, mitigation, and response, and demonstrate how effective the EAP will be in an actual emergency situation.

The DHS Homeland Security Exercise and Evaluation Program (HSEEP) offers a common exercise policy and provides program guidance that constitutes a national standard for exercises. HSEEP includes consistent terminology that can be used by all exercise planners, regardless of the nature and composition of their sponsoring agency or organization. This program offers useful tools that exercise managers can use to plan, conduct, and evaluate exercises to improve overall preparedness.

HSEEP is compliant with, and complements, several historical and current Federal directives and initiatives such as the National Strategy for Homeland Security; Homeland Security Presidential Directive (HSPD)-5, Management of Domestic Incidents; and HSPD-8, National Preparedness. In addition, HSEEP integrates language and concepts from the following:

- National Response Framework (NRF)—a guide to how the Nation conducts all-hazards response;
- National Incident Management System (NIMS)—a system that provides a consistent nationwide template to enable Federal, State, tribal, territorial, and local governments, the private sector, and nongovernmental organizations to work together to prepare for, prevent, respond to, recover from, and mitigate the effects of incidents; and
- National Infrastructure Protection Plan (NIPP)—the unifying structure for the integration of CIKR protection efforts into a single national program.

HSEEP is accepted as the standardized policy and methodology for the execution of the National Exercise Program (NEP). HSEEP is consistent with the FERC 12-Step Exercise Process guidelines.

HSEEP exercise types can be categorized as discussion-based or operations-based. Discussion-based exercises are orientation seminars, workshops, tabletops, and games. Drills, functional, and full-scale exercises are the operations-based exercises. The HSEEP descriptions of these exercises are presented in the following sections; guidelines for them are provided in Appendix D. Owners and operators within the Dams Sector may have different definitions of these exercise types stemming from their organizational processes.

It is not required that every exercise program include all types of exercises. However, it is advisable to build an exercise program upon competencies developed from simpler exercises to achieve greater success with the more complex exercises. This means that emergency exercises should be developed and conducted in an ascending order of complexity. It is important that sufficient time be provided between each exercise to learn and improve from the experiences of the previous exercise before conducting a more complex exercise. The exercise types, listed from simplest to most complex, are described below.

The status of training and levels of readiness should be evaluated in non-threatening, simulated, periodic emergency exercises for key personnel of the dam. Key personnel from State and local emergency management agencies should be encouraged to participate in any preplanning, training, and exercises whenever possible. Including other dam owners within the same drainage basin can be beneficial since they often interface with those same agencies. Involving relevant organizations and agencies will maintain plan familiarity among the participants and can help identify possible deficiencies of the plan. Informational site visits are also important in keeping potential responders familiar with the dam location, access routes, and key features.

Discussion-based Exercises

Discussion-based exercises are normally used as a starting point in the building-block approach of escalating exercise complexity. These exercises include seminars, workshops, tabletop exercises, and games. These types of exercises typically highlight existing plans, policies, interagency/inter-jurisdictional agreements, and procedures. Discussion-based exercises are valuable tools for familiarizing agencies and personnel with current or expected capabilities of an entity. These discussion-based exercises typically focus on strategic, policy-oriented issues. Facilitators and/or presenters usually lead the discussion and keep participants on track toward meeting exercise objectives.

Seminar

This exercise involves bringing together those with a role or interest in the plan—dam owner and State and local emergency management agencies—to discuss the plan and initial concepts for an annual drill or more in-depth comprehensive exercise. The seminar does not involve an actual exercise of the plan. Instead, it is a meeting that enables each participant to become familiar with the plan and the roles, responsibilities, and procedures of those involved. A seminar can also be used to discuss and describe technical matters with involved, non-technical personnel.

Workshop

Workshops represent the second tier of exercises in the HSEEP building-block approach. They differ from seminars in two important respects: participant interaction is increased, and the focus is on achieving or building a product (such as a draft plan or policy). Workshops are often used in conjunction with exercise development to determine objectives, develop scenarios, and define evaluation criteria. To be effective, workshops must be highly focused on a specific issue, and the desired outcome or goal must be clearly defined.

Tabletop

The tabletop exercise involves a meeting of the dam owner and the State and local emergency management officials in a conference room environment. The format is usually informal with minimum stress involved. The exercise begins with the description of a simulated event and proceeds with discussions by the participants to evaluate the plan and response procedures and to resolve concerns regarding coordination and responsibilities. Tabletop exercise participants are encouraged to discuss issues in depth and develop decisions through slow-paced problem solving, rather than the rapid, spontaneous decision making that occurs under actual or simulated emergency conditions. Tabletop exercises are effective for evaluating group problem solving, personnel contingencies, group message interpretation, information sharing, interagency coordination, and achievement of specific objectives.

Tabletop exercises can be either basic or advanced. In a basic tabletop, the scenario material remains constant; it describes an event or emergency incident and brings discussion participants up to the simulated present time. Players apply their knowledge and skills to a list of problems presented by a leader or moderator but the problems are discussed as a group and the leader summarizes problem resolutions.

By way of contrast, in an advanced tabletop the exercise revolves around delivery of pre-scripted messages to players that alter the original scenario. The exercise controller or moderator usually introduces problems one at a time in the form of a written message, simulated telephone call, videotape, or other means. Participants discuss the issues raised by the simulated problem and apply appropriate plans and procedures.

Games

Games are a simulation of operations that often involve two or more teams and use rules, data, and procedures to depict an actual or assumed real-life situation. The goal of a game is to explore decision-making processes and the consequences of those decisions. A game differs from the tabletop in that the sequence of events affects, and is in turn affected by, decisions made by players.

Computer-generated scenarios and simulations can provide a more realistic and time-sensitive method of introducing situations for analysis during the game. Planner decisions can be input into realistic models to show the effects of decisions made during a game. Internet-based, multi-player games offer many additional benefits, such as saving money by reducing travel time, offering more frequent training opportunities, and taking less time away from primary functions. They also provide a collaborative environment that reflects realistic occurrences.

Operations-based Exercises

Operations-based exercises are used to validate the plans, policies, agreements, and procedures solidified in discussion-based exercises. Operations-based exercises include drills, functional exercises, and full-scale exercises. They can clarify roles and responsibilities, identify gaps in resources needed to implement plans and procedures, and improve individual and team performance. Operations-based exercises are characterized by actual reaction to simulated intelligence; response to emergency conditions; mobilization of apparatus, resources, and/or networks; and commitment of personnel, usually over an extended period of time.

Drill

A drill is a low-level exercise that tests, develops, or maintains skills in a single emergency response procedure. An example of a drill is an in-house exercise performed to verify the validity of telephone numbers and other means of communication along with the dam owner's response. A drill is considered a necessary part of ongoing training and can be used to provide training on new equipment, develop or validate new policies and procedures, or maintain current skills. Drills have a narrow focus that is measured against established standards and performed in a realistic environment. Drills provide immediate feedback to participants.

Functional Exercise

A functional exercise is the highest level exercise that does not involve the full activation of the dam owner and State and local emergency management personnel and facilities, or test evacuation of residents downstream of the dam. It involves the various levels of the dam project and State and local emergency management personnel that would be involved in an actual emergency. The functional exercise takes place in a stress-induced environment with time constraints and involves the simulation of a dam failure or other specified events that require rapid and effective responses by trained personnel. The participants "act out" their actual roles. The exercise is designed to evaluate both the internal capabilities and responses of the dam owner and the workability of the information in the plan used by emergency management officials to carry out their responsibilities. The functional exercise also is designed to evaluate the coordination activities between the dam owner and emergency management personnel.

Full-Scale Exercise

A full-scale exercise is the most complex level of exercise. It evaluates the operational capability of all facets of the emergency management system—dam owner and State and local emergency management agencies—interactively in a stressful environment with time constraints and with the actual mobilization of personnel and resources. It includes field movement and deployment to demonstrate coordination and response capability. The participants actively "play out" their roles in a dynamic environment that provides the highest degree of realism possible for the simulated event. A full scale exercise of an EAP would simulate a dam failure and could include actual evacuation of residents if previously announced to the public.

The basic difference between functional and full-scale exercises is that a full-scale exercise involves actual field movement and mobilization, whereas field activity is only simulated in a functional exercise.

The primary objectives of a functional or full-scale exercise are to:

- Reveal the strengths and weaknesses of the plan, including specified internal actions, external notification procedures, and adequacy of other information, such as inundation maps.
- Reveal deficiencies in resources and information available to the dam owner and State and local agencies.
- Improve coordination efforts between the dam owner and State and local agencies.
- Clarify the roles and responsibilities of the dam owner and State and local emergency management officials.
- Improve individual performance of the people who respond to the dam failure or other emergency conditions.
- Gain public recognition of the emergency plans.
- Test the monitoring, sensing, and warning equipment at remote/unattended dams.
- Test the functionality of sirens or other types of public warning systems.

Exercise Frequency

For most dam owners, the orientation seminar, drill, tabletop exercise, and functional exercise should receive the most emphasis in their exercise programs. FEMA recommends that dam owners conduct a functional exercise at least once every 5 years. Tabletop exercises are usually conducted on a more frequent basis.

Full-scale exercises should be considered as optional emergency exercise activities, and should be conducted primarily when there is a specific need to evaluate actual field movement and deployment. When a full-scale exercise is conducted, safety becomes a major concern because of the extensive field activity. If a dam owner has the capability to conduct a full-scale exercise, a commitment should be made to schedule and conduct the entire series of exercises listed above before conducting any full-scale exercise. This will also require that at least one functional exercise be conducted before conducting a full-scale exercise. Functional and full-scale exercises can be coordinated with other scheduled exercises to share emergency management agency resources and reduce costs.

Post-Exercise Evaluation

A hot wash (for exercise players) and a debrief (for planners, facilitators, controllers and evaluators) should be conducted immediately following the exercise. A hot wash is conducted in each functional area by that area's controller or evaluator immediately following an exercise; it allows players the opportunity to provide immediate feedback. A debrief is a more formal forum for planners, facilitators, controllers, and evaluators to review and provide feedback on the exercise.

An after action report (AAR) should be developed upon conclusion of the exercise. The purpose of an AAR is to provide feedback to participants on their performance during the exercise. The AAR summarizes exercise events and analyzes performance of the tasks identified as important during the planning process. It also evaluates achievement of the selected exercise objectives and demonstration of the overall capabilities. After the AAR is complete, the last step is to develop an improvement plan. Its purpose is to convert lessons learned from the exercise into concrete, measurable steps that result in improved response capabilities.

Exercise Resources

The HSEEP website offers a range of tools that can facilitate exercise planning and execution. One online, comprehensive tool facilitates scheduling, deconfliction, and synchronization of all National-Level, Federal, State, and local exercises. A project management tool and comprehensive tutorial are available for the design, development, conduct, and evaluation of exercises. Another tool provides users with templates for developing timelines, planning teams, and exercise documentation.

The HSEEP is maintained by the Federal Emergency Management Agency's National Preparedness Directorate. More information can be found online, at https://hseep.dhs.gov/pages/1001_HSEEP7.aspx.

Appendix A: Emergency Action Plan Template

Emergency action plans (EAPs) are discussed in Section 4 of the handbook. EAP content is also discussed in more detail in *Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners* (FEMA 64), which can be obtained from FEMA in print or on CD, or is available online at http://www.fema.gov/plan/prevent/damfailure/fema64.shtm.

This appendix presents an EAP template, similar to an example EAP developed by the Natural Resource Conservation Service of the U.S. Department of Agriculture, dated September 25, 2006. This template might be suitable for use at some dams. The Federal Energy Regulatory Commission also has developed a similar template for use by its licensees. The dam owner must ensure that the EAP conforms to any applicable State or Federal requirements.

Samples of EAPs will be posted on the HSIN Dams Portal as they become available.

NOT FOR PUBLIC DISTRIBUTION

Emergency Action Plan

_____ Watershed

Any county, Any town, Any State

Structure: _____

National Inventory of Dams ID#: _____

OWNER: _____

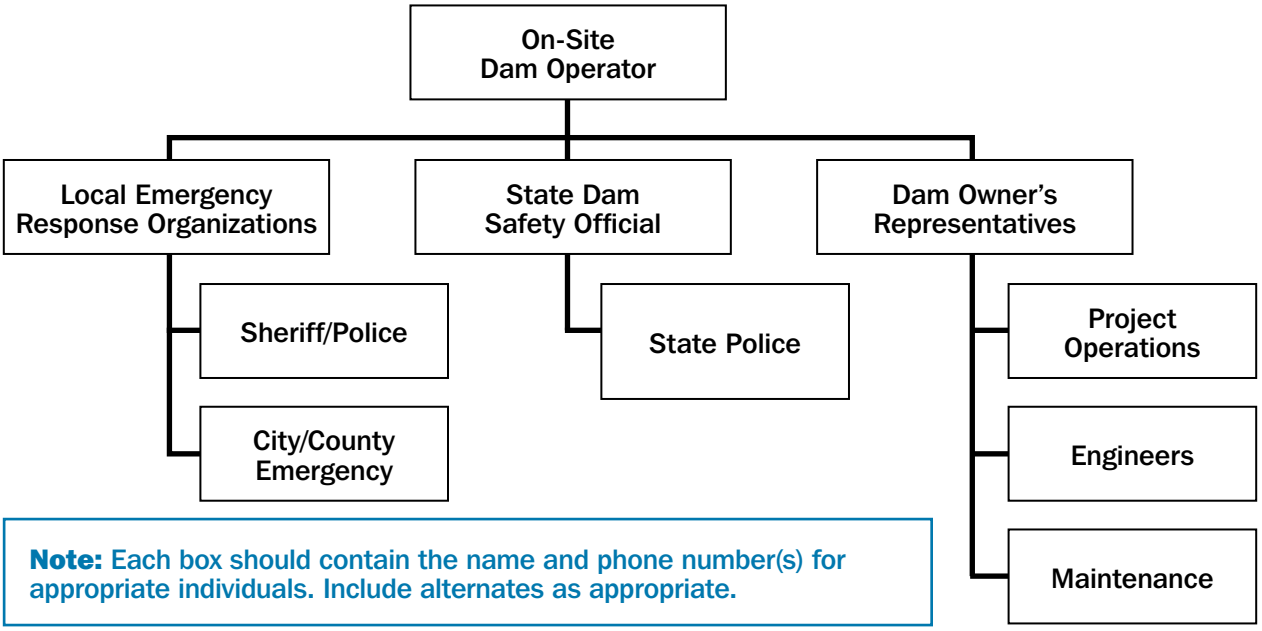
ISSUE DATE: _____

TABLE OF CONTENTS

I. NOTIFICATION FLOWCHARTS

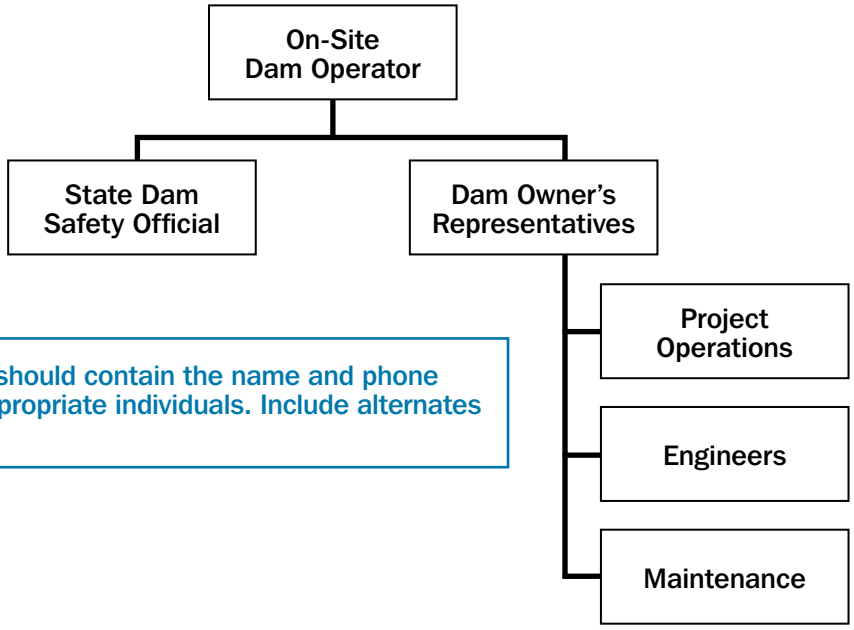
Warning: Notification charts must be customized per local circumstances

Notification Flowchart for Potential or Imminent Failure



Note: Each box should contain the name and phone number(s) for appropriate individuals. Include alternates as appropriate.

Notification Flowchart for Non-Failure Concern



Note: Each box should contain the name and phone number(s) for appropriate individuals. Include alternates as appropriate.

II. STATEMENT OF PURPOSE

The purpose of this plan is to prescribe procedures to be followed in the event of an emergency associated with the _____ Dam that is caused by an unusually large flood or earthquake; a structural malfunction of the gates on the principal spillway; malicious human activity such as sabotage, vandalism or terrorism; or failure of the dam.

This Emergency Action Plan (EAP) defines responsibilities and procedures to:

- Identify unusual and unlikely conditions that may endanger the dam.
- Initiate remedial actions to prevent a dam failure or minimize the downstream impacts of a dam failure.
- Initiate emergency actions to warn downstream residents of impending or actual failure of the dam.

III. PROJECT DESCRIPTION

Official Dam Name: _____ NID ID#: _____

Structure:

Stream:

Location: Lat. _____ Long. _____ Any county, Any State

Directions to dam:

Dam Owner/Operator:

Type of Dam:

Year Constructed:

Dam Height:

Dam Length:

Drainage Area:

Hazard Classification:

Principal Spillway Type:

Principal Spillway Capacity:

Auxiliary Spillway Type:

Max Capacity:

Maximum Storage Volume:

Elevations (Mean Sea Level):

Principal Spillway Crest:

Auxiliary Spillway Crest:

Top of Dam:

Impact Basin:

Vertical Datum Used:

Description of Impacted Property: (list residences, businesses, infrastructure, etc.)

[Add vicinity map that shows the location of the dam with respect to nearest town]

[Add plan view of dam from construction drawings]

[Add aerial photographs]

IV. EMERGENCY DETECTION, EVALUATION AND CLASSIFICATION

Daily surveillance and instrumentation readings at the site will be the normal methods of detecting potential emergency situations. For conditions beyond the normal range of operations, contact the Dam Safety Office (DSO) for assistance with evaluation of the conditions.

Each event or situation will be placed in one of the following classifications:

- **Non-failure Concern**—This classification indicates a situation is developing; however, the dam is not in danger of failing, but flooding is expected downstream from the dam. Downstream residents need to be notified if flooding increases and life and property are threatened.
- **Potential Failure**—This classification indicates that a situation is developing that could cause the dam to fail. Residents in affected areas shall be alerted that an unsafe situation is developing. A reasonable amount of time is available for analysis before deciding on evacuation of residents.
- **Imminent Failure**—This classification indicates dam failure is occurring that may result in flooding that will threaten life and property. When the sponsor/land user determines that there is no longer time available to implement corrective measures to prevent failure, an order for evacuation of residents in potential inundation areas shall be issued.

Listed below are some of the events that can lead to the failure of the dam and a brief outline of steps to take to address the situation. See the "Preparedness" section for a summary of actions to be considered for various situations.

FLOODING:

The _____ Dam is designed to safely convey the expected runoff from a _____ (____inches in ____ hours). However, if during a major flood event, the reservoir level rises to within 1 foot of the top of dam (elevation _____), conduct periodic (at least daily) inspections of the dam to check for and record the following:

- reservoir elevation;
- rate the reservoir is rising;
- weather conditions—past, present, predicted;
- discharge conditions of creeks and rivers downstream;
- downstream toe and abutments for any new seepage or abnormal (muddy flow) toe drain leakage;
- increased seepage rate as reservoir level rises;
- cracks, slumping, sloughing, sliding, or other distress signals near the dam abutment or crest.

If any of the above conditions occurs, implement the **Notification Flowchart for Potential or Imminent Failure**.

EROSION, SLUMPING/SLOUGHING, OR CRACKING OF THE DAM OR ABUTMENT:

Determine the location, size of the affected area(s) (height, width, and depth), severity, estimated seepage discharge, clear or cloudy seepage, and the reservoir and tail water elevations. If the integrity of the dam appears to be threatened, immediately implement the **Notification Flowchart for Potential or Imminent Failure**.

NEW SPRINGS, SEEPS, BOGS, SANDBOILS, INCREASED LEAKAGE, OR SINKHOLES:

If there is a rapid increase in previously existing seep areas, an increase in toe drain flow, or if new springs, seeps, or bogs appear, determine the location, size of the affected area, estimated discharge, nature of the discharge (clear or cloudy), and reservoir and tail water elevations (a map of the area may be helpful to illustrate where the problem is located). If the integrity of the dam appears to be threatened, immediately implement the **Notification Flowchart for Potential or Imminent Failure**.

ABNORMAL INSTRUMENTATION READINGS:

After taking instrumentation readings, compare the current readings to previous readings at the same reservoir level. If the readings appear abnormal, determine reservoir and tail water elevations, and contact the State Dam Safety Officer.

MALICIOUS HUMAN ACTIONS (SABOTAGE, VANDALISM, OR TERRORISM):

If malicious activity on or around the dam has been identified, immediately make an assessment of the existing conditions and determine the potential for dam failure. If the integrity of the dam appears to be threatened, immediately implement the **Notification Flowchart for Potential or Imminent Failure**.

DECLARING AN EMERGENCY AND IMMEDIATE ACTIONS

Emergency Level 1: Non-emergency, Unusual Event; Slowly Developing:
Contact the State Dam Safety Officer. Describe the situation and discuss the next steps that should be taken.

Emergency Level 2: Potential Dam Failure Situation; Rapidly Developing:
The following message may be used to help describe the emergency situation to local law enforcement and emergency management personnel:

> "This is ____*your name and position*____. We have an emergency condition at ____*dam name and location*____. We have activated the Emergency Action Plan and are currently under emergency level 2. We are responding to a rapidly developing situation that could result in dam failure. Please prepare to evacuate low-lying areas along ____*name of stream*____, per the evacuation map in your copy of the Emergency Action Plan. I can be contacted at ____*phone number*____. If you cannot reach me, please call ____*name of alternate contact and phone number*____."

Emergency Level 3: Urgent; Dam Failure is in Progress or Appears to be Imminent:
Call the local law enforcement dispatch center immediately; say "This is an emergency." They will call other authorities and the media and begin the evacuation. The following message may be used to help describe the emergency situation to law enforcement and emergency management personnel:

> "This is an emergency. This is ____*your name and position*____. ____*Dam name and location*____ is failing! The downstream area must be evacuated immediately. Repeat: ____*Dam name and location*____ is failing! The downstream area must be evacuated immediately. Evacuate low-lying areas along ____*name of stream*____, per the evacuation map in your copy of the Emergency Action Plan. We have activated the Emergency Action Plan and are currently under emergency level 3. I can be contacted at ____*phone number*____. If you cannot reach me, please call ____*alternate number*____."

END OF EMERGENCY SITUATION AND FOLLOW-UP ACTIONS

Once conditions indicate that there is no longer an emergency at the dam site, _____ will contact the *Any county* Emergency Management Agency, which will then terminate the emergency situation.

V. DIRECTORY OF ADDITIONAL PERSONNEL WITH DAM SAFETY EXPERTISE

In addition to personnel shown elsewhere in this plan, the following list identifies other individuals with expertise in dam safety, design and construction who may be consulted about taking specific actions at the dam when there is an emergency situation:

Name	Telephone	Responsibility

VI. PREPAREDNESS

Preparedness actions are taken to prevent a dam failure incident or to help reduce the effects of a dam failure and facilitate response to emergencies. The following actions describe some of the steps that could be taken at the dam to prevent or delay failure after an emergency is first discovered. **These actions should only be performed under the direction of the dam safety office or other qualified professional engineers**.

ACTIONS TO BE TAKEN IN THE EVENT OF:

Overtopping by Flood Waters:

- Provide erosion-resistant protection to the downstream slope by placing plastic sheets or other materials over eroding areas.
- Divert floodwaters around the reservoir basin, if possible.

A Slide on the Upstream or Downstream Slope of the Embankment:

- Lower the water level in the reservoir at a rate, and to an elevation, that is considered safe given the slide condition. If the outlet is damaged or blocked, pumping, siphoning, or a controlled breach may be required.
- Stabilize slides on the downstream slope by weighting the toe area below the slide with additional soil, rock, or gravel.

Erosional Seepage or Leakage (Piping) through the Embankment, Foundation, or Abutments:

- Plug the flow with whatever material is available (hay bales, bentonite, or plastic sheeting, if the entrance to the leak is in the reservoir).
- Lower the water level in the reservoir until the flow decreases to a non-erosive velocity or until it stops.
- Place an inverted filter (a protective sand and gravel filter) over the exit area to hold materials in place.
- Continue lowering the water level until a safe elevation is reached; continue operating at a reduced level until repairs are made.

Failure of an Appurtenant Structure such as an Inlet/Outlet of Spillway:

- Implement temporary measures to protect the damaged structure, such as closing the inlet or providing temporary protection for a damaged spillway.
- Employ experienced, professional divers, if necessary, to assess the problem and possibly implement repair.
- Lower the water level in the reservoir to a safe elevation. If the inlet is inoperable, pumping, siphoning, or a controlled breach may be required.

Mass Movement of the Dam on its Foundation (Spreading or Mass Sliding Failure):

- Immediately lower the water level until excessive movement stops.
- Continue lowering the water level until a safe level is reached; continue operation at a reduced level until repairs are made.

Spillway Erosion Threatening Reservoir Evacuation:

- Provide temporary protection at the point of erosion by placing sandbags, riprap materials, or plastic sheets weighted with sandbags. Consider pumps and siphons to help reduce the water level in the reservoir.
- When inflow subsides, lower the water level in the reservoir to a safe level; continue operating at a lower water level in order to minimize spillway flow.

Excessive Settlement of the Embankment:

- Lower the water level by releasing it through the outlet or by pumping or siphoning.
- If necessary, restore freeboard, preferably by placing sandbags.
- Lower water level in the reservoir to a safe level; continue operating at a reduced level until repairs can be made.

Malicious Human Activity (Sabotage, Vandalism, or Terrorism)

- If malicious human activity that could endanger public safety is suspected, contact law enforcement to help evaluate the situation.
- If the principal spillway has been damaged or plugged, implement temporary measures to protect the damaged structure. Employ experienced, professional divers, if necessary, to assess the problem and possibly implement repair.
- If the embankment or spillway has been damaged or partially removed, provide temporary protection in the damaged area by placing sandbags, riprap materials, or plastic sheets weighted with sandbags. Use pumps and siphons to help reduce the water level in the reservoir.
- If the water supply has been contaminated, immediately close all inlets to the water supply system and notify appropriate authorities.

SUPPLIES AND RESOURCES

In an emergency situation, equipment, supplies and other resources might be needed on short notice. Examples are sandbags, riprap, fill materials, and heavy equipment. The table below lists resources that may be helpful and indicates contacts to access them.

Item	Contact	Location
Earthmoving Equipment		
Riprap		
Sand and Gravel		
Sandbags		
Pumps		
Pipe		
Laborers		
Lighting Equipment		

VII. BREACH INUNDATION MAP

___ homes could be affected by a major flood caused by a sudden breach of the dam. These homes are marked on the attached inundation map. Floodwaters would reach the first home approximately ___ minutes after the dam failure.

Number	Resident	Distance Downstream	Max Water Depth (above 1st Floor)

(Provide similar information for businesses and other non-residential structures)
(Attach Inundation Map)

VIII. PLAN MAINTENANCE

This plan shall be reviewed and updated annually (and whenever needed due to changed conditions) by the dam owner and local emergency management agency personnel. All signatory parties to this plan should be encouraged to review the plan to assure all names and contact information are current. Revisions shall be promptly provided to all parties.

IX. TRAINING

All people involved in the EAP shall be trained to ensure that they are thoroughly familiar with the elements of the plan, availability of equipment, and their responsibilities and duties in the plan. Personnel shall be trained in problem detection and evaluation, and appropriate corrective measures. This training is essential for proper evaluation of developing situations at all levels of responsibility.

A tabletop exercise shall be conducted at least once every 5 years. The tabletop exercise involves a meeting of the dam owner and State and local emergency management officials in a conference room environment. The exercise begins with a description of a simulated event and proceeds with discussions by the participants to evaluate the EAP and response procedures, and to resolve concerns regarding coordination and responsibilities.

X. DISTRIBUTION

Copies of this Emergency Action Plan have been provided to all individuals or groups who are signatory parties to the plan. Large-scale maps are on file with the local emergency management agency for evacuation purposes.

XI. APPROVAL OF THE PLAN

We, the undersigned individuals, as authorized by the laws and regulations of the State of _____, hereby adopt this Emergency Action Plan and agree to execute it.

_____ _____

Name/Title Date

(Provide signatures of key responsible parties for the dam owner, state/local emergency managers, and local response organizations)

XII. REVIEW AND UPDATE OF THE PLAN

This plan will be reviewed and updated annually and tabletop exercises will be conducted at least once every five years. Document these reviews below:

Date of review: _____ Participants: _____

Date of review: _____ Participants: _____

Date of review: _____ Participants: _____

Date of tabletop exercise: _____

Appendix B: Recovery Plan Content Guidelines

Recovery plans (RPs) are discussed in Section 5 of this handbook. The plans should provide information to deal with mitigation and emergency repair of affected projects for any emergency arising at the site, whether from natural or manmade causes. This appendix provides two sample tables of content for RPs and detailed RP content guidelines. This information might be suitable for use at some dams.

Samples of recovery plans will be posted on the HSIN Dams Portal as they become available.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) requires RPs for many of its dams and navigation locks. Many parts of the USACE guidelines are similar to those issued by the Federal Energy Regulatory Commission (FERC), discussed below. One USACE district developed a generic RP to cover all of its affected projects. Following is a partial table of contents for the plan. This demonstrates that the plan should address more than simply the physical repair or reconstruction issues.

Sample RP Table of Contents for a USACE District

- Purpose
- Recovery Organization
- Description of Projects
- Coordination Responsibilities
    - Within USACE
    - With Local, State and Federal Agencies
- Response and Recovery Operations
    - Incident Command and Management
    - Procurement Procedures
    - Resource Coordination
    - Mutual Aid
    - Public Information Dissemination

- Response and Recovery Actions
    - Site Security
    - Continuity of Operations
    - Restoration of Critical Infrastructure
- Training and Exercises
    - Training
    - Exercises
    - Evaluation and Corrective Action
- Plan Maintenance

Federal Energy Regulatory Commission

The FERC has issued guidelines for use by its licensees when developing an internal emergency recovery plan to supplement their emergency action plan. An abbreviated version of these guidelines is provided below. The complete guidelines are available on the HSIN Dams Portal.

The FERC guidelines frequently address issues that are specifically related to hydroelectric power generation, and sometimes refer to specific licensee requirements. The guidelines consist of a recommended table of contents, and a content description for each of the main sections. These FERC guidelines include fairly comprehensive coverage of issues related to the primary recovery activities. The guidelines also address related issues such as incident command system responsibilities, coordination, communications, and logistics. FERC suggests that the main body of the plan (not including the appendices) could be less than 25 pages.

Sample Table of Contents

I. Purpose of Internal Plan

II. Applicable Emergency Scenarios

A. Overtopping (including excessive inflow or reservoir displacement)

B. Earthquake Damage

C. Loss of Dam Crest Length

D. Slide on Upstream or Downstream Slope of Embankment

E. Slide on Underlying Potential Failure Plane

F. Excessive Settlement

G. Sinkhole Activity

H. Loss of Foundation or Abutment Material (such as landslide/rockfall)

I. Excessive Seepage/Piping through Embankment, Foundation, or Abutments

J. Failure of Appurtenant Structure Such as a Spillway Gate

K. Excessive Cracking in Concrete Section

L. Penstock Rupture/Failure

M. Turbine or Other Equipment Failure

N. Vandalism/Bomb Threat/Terrorism

O. Other

III. Incident Command System (ICS) & Company Internal Assignments/Responsibilities

A. Incident Command System (ICS)

B. ICS Chart: Company Personnel Assignments

C. Incident Command Post and Alternate Command Post

D. Personnel at On-Site Incident Command Post

E. Main Headquarters Emergency Personnel

F. Media Contact (Public Information Officer)

IV. Coordination with Local Authorities

A. Multiple-Jurisdiction Incident (Unified Command)

B. Safety/Clearance Issues & Authorization

V. Communications, Maps, and Drawings

A. Communications Center

B. Alternate Communications Methods (cell phone, radios)

C. Drawings, Maps, Photographs

VI. Vehicles, Equipment, Materials (e.g., sandbags, concrete, rip rap) & Contractors

A. Plant On-Site Inventory

B. Other Available Company Vehicles, Equipment, Materials, & Supplies

C. Non-Company Supplies/Materials (including helicopters if necessary)

D. Outside Contractors and Consultants

VII. Response Times & Geographical Limitations

A. Call-out Procedure

B. Estimated Response Times

C. Primary & Secondary Access Roads & Alternatives

D. Staging Areas for Personnel & Equipment

VIII. Meals & Lodging

A. Company Living Facilities

B. Local Restaurants & Motels

IX. Internal Maintenance of Plan

Appendices

A. List of Company Response Personnel (internal call-out list of phone numbers)

B. List of Contractors/Consultants (addresses and phone numbers)

C. List of Equipment Suppliers (addresses and phone numbers)

D. Local Restaurants & Motels (addresses and phone numbers)

E. Other Utilities/Mutual Aid (phone numbers of key contacts)

F. Federal/Governmental Assistance (phone numbers of key contacts)

G. Engineering Key Drawing List (drawings are located in two secure, non-inundated areas near the facility)

H. Highway Maps and Photos of Dam

I. Emergency Helicopter Rescue Numbers

J. Bomb Threat Procedures

K. EAP Flowcharts A and B (identical to those in the regular EAP)

Guidance for the Preparation of the Recovery Plan

The plan is developed primarily for the benefit of the dam owner, but also will be beneficial to the region or country by rapidly recovering essential project benefits. Having a comprehensive plan enables dam owners to more quickly mitigate, recover, and "get back on line" following a serious incident at a facility. It makes good business sense to formulate an RP for those facilities that would (if they failed) most seriously impact the generating capability and/or economic bottom line. RPs are not necessarily applicable for every High Hazard Potential facility.

The recovery phase should begin as soon as possible after the catastrophic event (dam failure, loss or damage to powerhouse, loss of main transmission line, etc.) and usually overlaps the "response phase" of the event. Planning and actions during the "response phase" should consider any actions that might be implemented to return the dam to service.

Recovery phases include "initial" (within one week) and "long-term" activities (recovery could continue for months), depending upon the magnitude of impact on facility operations, including dams, powerhouses, and water conveyance.

Section I. Purpose of Internal Plan

This Internal Emergency Recovery Plan (IERP) is designed as a separate document that can supplement the primary Emergency Action Plan (EAP). Whereas the primary EAP is designed to facilitate early warning and evacuation of potentially affected downstream areas, the IERP deals with mitigation and emergency repair of affected company structures and plant facilities. A RP should be prepared on a site-specific basis since different facilities (i.e., dams and associated structures) will require different considerations. The RP is not intended to be a company-wide Continuity of Operations Plan, but rather a plan to bring a specific facility back in operation as efficiently as possible. It is intended for internal use and response only.

Section II. Applicable Emergency Scenarios

The description of each scenario need only be one page in length, including primary concerns, materials/equipment needed, and operating procedures. A universe of potential emergency scenarios need not be listed for each facility, but rather the list should be tailored to the specifics of the facility. For example, "Overtopping" may be a minor concern for a facility designed to accommodate flows over the entire structure. A good start in developing applicable emergency scenarios is the Potential Failure Modes Analysis (PFMA) document prepared for the facility, although all applicable scenarios, such as terrorism, may not be covered in the PFMA.

Each critical component for the applicable scenario should be identified with the likely range of potential hazards and consequences. Predict the type and magnitude of damage, and develop a list of options to minimize the consequences, either by reducing initial damage, or by limiting progression of the initial damage, or by reducing the time needed to repair the damage. Results of this effort should be consolidated into a list of recommended actions that might include procurement, stockpiling, on-the-shelf designs, or general preparedness actions. Following are brief examples of what a component analysis could entail.

Component: Switchyard transformer

Likely type/magnitude of damage: Ballistic damage to shell and windings

Consequences of damage: No immediate loss of hydropower transmission, due to availability of redundant transformer capacity. Less reliable system until transformer is replaced (normal 18-month replacement time); possible power loss would represent a very small percentage of regional capacity

Options to minimize consequences:
1. Rely on existing redundant transformer capacity
2. Install additional redundant capacity
3. Emergency procurement of new transformer (9 months)

Recommended option: #1, but this will limit system reliability until a new transformer is online

Component: Tainter gates

Likely type/magnitude of damage: Trunion pin failure deforms gate, making gate inoperable

Consequences of damage: Until gate is replaced (normal 14-month replacement time), loss of pool, reduction of recreation, loss of power production

Options to minimize consequences:
1. Procure and store a spare gate (2 week recovery)
2. Emergency procurement of a new gate (9 months)
3. Procure and store a bulkhead to restore pool until new gate is installed

Recommended option: #3, because bulkhead will be suitable for use at 5 company projects

Section III. Incident Command System (ICS) & Company Internal Assignments/Responsibilities

The purpose of this section is to describe the emergency response structure within which the dam owner will operate, and briefly discuss the roles and responsibilities expected from personnel internal to the dam owner's organization. Another important consideration to address is the role and responsibility of the dam owner personnel to respond to the emergency, both in an initial and a long-term basis. Things to consider are discussed in the following sections (but are not necessarily limited to the items described here).

Section IV. Coordination with Local Authorities

This section should briefly discuss what the dam owner needs to do to coordinate with the local law enforcement and emergency response personnel they will work with, and any special needs they have identified. The complete list of applicable agencies would be included in the EAP notification flowcharts.

Section V. Communications, Maps, and Drawings

This section should list how communications will occur throughout the emergency, list alternate communication sources, and include a brief section with pertinent maps, drawings and photographs that would be useful to have during an emergency. Maps, drawings and photographs may be included in the appendices.

Section VI. Vehicles, Equipment, Materials (e.g., sandbags, concrete, rip rap) & Contractors

This section should list all the vehicles, materials and equipment the dam owner would need to respond to the applicable emergency scenarios identified in Section II. A current list of contractors and support personnel that can be utilized during the emergency should also be listed in this section for easy reference.

Section VII. Response Times & Geographical Limitations

Anticipated response times, call-out procedures and geographic limitations should be addressed in this section. Clearly defined directions to critical areas and other locations should be included in textual and graphical format. Security exclusion zones and potential staging areas should also be identified.

Section VIII. Meals & Lodging

Any logistical considerations for sustaining personnel detailed to temporary quarters should be identified in this section.

Section IX. Internal Maintenance of Plan

This section should address how the Recovery Plan is maintained (updated). Internal employee training of the procedures and information contained within the Plan should also be defined.

Appendices

The most critical section of the Plan is the Appendix section (the "nuts and bolts" that help mitigate/recover from the emergency). The appendices could probably suffice by themselves as the "recovery" plan for most dams. They contain information that most dam owners undoubtedly (and hopefully) already have on file somewhere to mitigate an emergency. This information could simply be consolidated into a single document. Appendices should be designed so that critical information contained therein may easily be verified and updated on an annual basis.

Appendix C: Continuity Plan Guidelines

As discussed in Section 6, organizations develop continuity plans to facilitate performance of their essential functions in situations that challenge their normal operations. The scale of operations will dictate if one continuity plan will be sufficient or if multiple, discrete plans constitute an organization's continuity program. Continuity plans could be developed for escalating operations in the event of a natural disaster or manmade incident, blackstart contingencies, civil unrest, pandemics, labor unrest, or physical security or cybersecurity breaches.

Appendices C1 and C2 contain information that can be helpful in developing continuity plans for two areas of particular recent interest to many organizations: pandemics and computer incidents. Continuity plan templates for these and other topics will be posted on the HSIN Dams Portal as they become available.

As with the other plans discussed in this handbook, continuity plans must be made readily available to the people who need them and sensitive business or security information must be protected. They also must be updated on a regular schedule or as circumstances warrant.

The following basic guidelines for continuity planning have been drawn from NFPA 1600, *Standard on Disaster/Emergency Management and Business Continuity Programs*, issued by the National Fire Protection Association, which should be consulted for a more thorough discussion of the planning process.

- Clearly state objectives of the plan; and
- Identify
    - functional roles and responsibilities of internal and external agencies and organizations;
    - lines of authorities for those agencies and organizations;
    - logistics support;
    - resource requirements;
    - process for managing an incident; and
    - systems for managing communication and information flow.

Based on those suggested guidelines, a continuity plan could be structured as described by the following table of contents.

Continuity Plan

Table of Contents

Appendix C1: Pandemic Preparedness Guidelines

Pandemic preparedness planning has been a focus area for many governments and organizations. The following table identifies generic types of planning actions that might be taken by a typical organization for the inter-pandemic, pandemic alert, and pandemic periods. The actions are keyed to pandemic phases defined by the U.S. Government. The generic actions in the table should be expanded into more detailed lists of specific actions applicable to a specific organization. An expanded version of the table is available on the HSIN Dams Portal. Additional pandemic planning information is available at www.pandemicflu.gov.

US Government Stages	Response Actions
INTER-PANDEMIC PERIOD	
0 New Domestic Animal Outbreak in At-Risk Country	• Develop and refresh business continuity plans based on pandemic threat impact issues • Prioritize business processes and associated personnel, equipment or supplies • Promote organizational preparedness and planning • Conduct validation exercises
PANDEMIC ALERT PERIOD	
1 Suspected human outbreak overseas	• Initiate company monitoring of disease • Provide appropriate awareness communications
2 Confirmed human outbreak overseas	• Heighten company monitoring of disease • Supplement awareness communications, as appropriate • Monitor travel situation and initiate advisories as needed • Evaluate potential need for stockpiling of materials or supplies • Review and refresh organizational preparedness plans
PANDEMIC PERIOD	
3 Widespread human outbreaks in multiple locations overseas	• Consider limited activation of crisis management teams • Evaluate need to implement supplemental staffing strategies • Review or update response and business continuity processes associated with next level escalation • Advise employees on personal protection strategies • Implement travel restrictions as appropriate • Ramp up communications and preparedness education • Resolve stockpiling concerns and order materials as appropriate
4 First human cases in North America	• Activate crisis / emergency management teams • Evaluate communication needs and adjust as required • Consider monitoring / surveillance practices • Encourage individual protection strategies • Implement general worker protection strategies • Implement mitigation processes involving critical and essential business processes and personnel
5 Spread throughout United States	• Address transportation issues • Enhance communications • Enhance employee social / psychological support processes • Anticipate economic / social disruptions and mitigate as appropriate
6 Recovery and preparation for subsequent waves	• Overcome impacts of skilled worker and critical supplies shortages • Evaluate and adjust response actions • Prepare for next pandemic wave

In addition, the US Department of Homeland Security (DHS) has developed a draft guideline titled *Pandemic Influenza: Preparedness, Response, and Recovery—Guide for critical infrastructure and key resources.* This guide contains an annex specifically intended for the Dams Sector. That annex contains lists of actions and planning questions grouped under the following headings:

- Identify and assess essential services, functions, and processes.
- Review equipment and assets critical to support each essential function.
- Prepare to sustain essential assets for a wave lasting up to 12 weeks.
- Identify materials and supplies to sustain essential functions and assets for up to 12 weeks.
- Determine the most effective ways to ensure an adequate supply of essential materials.
- Identify the types and numbers of workers critical to sustain essential functions.
- Identify policies and procedures to protect and sustain workers during an influenza pandemic.
- Identify human resource and protective actions to sustain essential workforce.
- Identify interdependent relationships and take actions to sustain those essential supports.
- Identify Federal, State, and local regulatory requirements that may affect facility operations.
- Identify effects from mitigation strategies; take actions to reduce negative impacts.

A full copy of this DHS guide is available at www.pandemicflu.gov, along with additional information on pandemic influenza preparedness. A copy of the North American Electric Reliability Corporation (NERC) *Electricity Sector Contagious Disease Pandemic Planning, Preparation and Response Reference Guide* and a sample plan will be posted on the HSIN Dams Portal.

Appendix C2: Computer Incident Response Guidelines

This appendix provides brief content guidelines that might be used for development of a continuity and response plan for a Computer Incident Response Team (CIRT). Samples of Computer Incident Response Plans will be posted on the HSIN Dams Portal as they become available. The National Institute of Standards and Technology (NIST) Special Publication 800-61, *Computer Security Incident Handling Guide* (draft) dated September 2007 contains detailed recommendations on computer security response planning and provides an extensive list of online tools and resources.

1. Document Control

Provide information such as: document name and version number, date of last revision, distribution lists or restrictions.

2. Introduction

Identify purpose and scope of the document

3. Types of Threats

Threat Category	Threat Definition
Automated Attacks	Software attacks such as viruses, worms, Trojan horses
External Attacks	Outside individual attempting to gain unauthorized access
Internal Attacks	Employees or contractors attempting unauthorized access to information or Internet sites.

4. Alert Categories

Identify organization alert levels. These might be correlated with the five-level, color-coded Homeland Security cyber alert levels:

Cyber-GREEN (Low)

Cyber-BLUE (Guarded)

Cyber-YELLOW (Elevated)

Cyber-ORANGE (High)

Cyber-RED (Severe)

5. CIRT Escalation Criteria

Provide guidelines for identifying the current organization alert level and for activating the response team. Identify who has the authority to make these decisions.

6. Response Guidelines

Provide lists of expected actions by various teams/members for various types of incidents. This will not be an all-inclusive list and some measures might not be applicable against a specific threat; however, the lists will provide a convenient checklist to help guide response actions. Implementation of these measures will be at the discretion of the teams. The list should include useful information such as command post locations, and instructions for obtaining information updates during the response.

7. Status Reports

The CIRT should provide periodic status reports during response to an incident. These reports should be forwarded to management and to affected portions of the organization. This section should identify intervals for meetings and status reports, and suggested distribution lists for the reports.

8. CIRT Plan Maintenance

The CIRT Plan should be reviewed/updated at least annually.

9. Exercises

The CIRT process should be tested twice annually and include tests of the notification lists and a simulation of some type of incident. This simulation might be considered a tabletop exercise. The objective should be to identify any hardware, system software, or applications that may need to be changed to better ensure computer security.

Attachment A—Computer Incident Response Process Overview

This section should outline the response process. The principle objective of an incident response plan is to ensure business continuity and to support recovery efforts. The initial response should include a rapid assessment of the situation and the execution of a number of "immediate action" steps designed to contain the problem and limit further damage. Typical response processes might include the following:

- Determine the nature of the incident
- Determine if the incident is malicious or non-malicious in origin
- Analyze available data sources
- Respond
    - Isolate compromised host
    - Block malicious traffic with existing security devices
    - Patch/harden to address specific vulnerability
    - Report to law enforcement if criminal activity is suspected
- Recover
    - Recover compromised hosts
    - Survey infrastructure for other vulnerable hosts, patch/harden as appropriate
    - Quantify loss if seeking legal remedies
    - Monitor host and network for signs of subsequent compromise
    - Conduct post-mortem analysis
    - Revise procedures and training based on post-mortem analysis

Attachment B—Call Lists

Provide contact information for key personnel. This list should include incident response team members, management, IT organizations, and persons in potentially affected operational areas.

Attachment C—Technical Impact Assessment

This section should provide guidelines for a thorough assessment of the potential impact of a specific threat. It should address items such as:

- Type of threat
- Source of the threat
- Actions that can be taken to mitigate the threat
- The prevalence of the target of the threat

Attachment D—Business Impact Assessment

This section should identify the types of information needed to determine the impact on critical business systems. This might include:

- What type of technology is affected by the incident
- Is the incident limitable by location; can it be contained
- Who is the person on-call for the application; have they been contacted; how quick can the response be
- Will company revenues be impacted
- Is the external customer impacted

Attachment E—Communications Process

This section should identify:

- Key communications contacts, roles, and responsibilities
- Target audiences and the most effective means to reach these audiences
- Steps in the communications process
- Sample messages

Attachment F—Post-Incident Evaluation

Include guidelines for:

- Collecting information
- Determining the cause of the incident
- Determining the effects of the incident
- Making recommendations for improvements to the systems
- Making recommendations for improvements to the incident response

Appendix D: Exercise Guidelines

Exercises are discussed in Section 7 of this handbook; the section also briefly describes seven different types of exercises. Although the exercise types will vary significantly in terms of scope and scale, the same general framework can be applied when planning most of the exercise types. This appendix describes that basic framework. It then provides HSEEP guidelines that can be useful when planning specific types of exercises. Example statements are printed in italics.

Samples of exercise plans will be posted on the HSIN Dams Portal as they become available.

Exercise Framework Guidelines

Define the Purpose of the Exercise

A clear definition of the need for the exercise and the purpose for conducting it will aid the planning process by clarifying who should be involved and exercise scope (e.g., tabletop, game, full-scale). The following need and purpose statements were based on a tabletop exercise template provided by Alliant Energy:

Our business is highly dependent on moving information across telecommunication networks. We need to be prepared to continue important business activities even if telecommunication networks stop functioning. The purpose of this exercise is to ensure that business groups can adapt to unpracticed emergency situations, like loss of telecommunication networks, and understand the actions that may be needed to keep important business functions operating.

Assemble the Planning Team

The size of the planning team and representation on it is dependent on the scope of the exercise. The team should include representatives from all the major facility organizations involved in the exercise and local law enforcement and first responders.

Develop the Scenario

The planning team's initial task is development of the exercise scenario. The scenario should be a plausible event scaled to the purpose of the exercise. The following sample scenario was developed for a full-scale exercise:

An individual wearing a backpack was found lying unconscious inside the north gate. The backpack was leaking an orange liquid. A security officer approached the individual and has been rendered unconscious. An unidentified individual was seen running from the vicinity of the administration building and has caused an explosion resulting in a fire inside the building. His current whereabouts are unknown but he is believed to be somewhere on the site.

Develop Exercise Guidelines

Depending on the type of exercise and the scenario, the planning team should describe any limitations placed on the design, development, and implementation of the exercise. Limitations could be the ability of responders to participate, lengthy authorization protocols, areas that may be off-limits for safety reasons, or financial constraints. The following is an example of a guideline:

No personnel may enter the switchyard at any time because it will continue to be energized.

Build Master Scenario Events List (MSEL)

The MSEL developed by the planning team lists the exercise messages and key events used to fully play out the scenario. The MSEL specifies the time a message is expected to be delivered, who delivers it to whom, a message number, and a short description of the message.

Prepare Exercise Materials and Evaluator Guides

Participants should receive invitation letters describing the exercise purpose and goal; scenario descriptions pertaining to their role; and safety, health, and logistics plans. Equally important are the guidelines developed for the observers who will be evaluating actions and decisions as the exercise unfolds.

Complete Post-Exercise Evaluation

Post-exercise evaluations provide the basis for improving the plans or procedures that were tested as part of the exercise.

Appendix D1: Guidelines for Seminars

Seminars can be used to address a wide range of topics. Although the topics may vary, all seminars share the following common attributes.

- They are conducted in a low-stress environment.
- Information is conveyed through different instructional techniques, which may include lectures, multimedia presentations, panel discussions, case study discussions, expert testimony, decision support tools, or any combination thereof.
- Informal discussions are led by a seminar leader.
- There are no real-time "clock" constraints.
- They are effective for both small and large groups.

Prior to participating in a seminar, participants should have a clear understanding of exercise objectives, which can range from developing new standard operating procedures to attaining priority capabilities. Seminars are typically conducted in a lecture-based format with limited feedback or interaction from participants.

Appendix D2: Guidelines for Workshops

To be effective, workshops must focus on a specific issue, and the desired outcome, product, or goal must be clearly defined. Workshops provide an ideal forum for the following activities.

- Collecting or sharing information;
- Obtaining new or different perspectives;
- Testing new ideas, processes, or procedures;
- Training groups to perform coordinated activities;
- Problem-solving complex issues;
- Obtaining consensus; and/or
- Building teams.

Typically, workshops begin with a presentation or briefing, during which the background and rationale for the workshop are conveyed, and specific activities and expected outcomes are delineated. The presentation is typically followed by facilitated breakout sessions, in which workshop participants break into groups for focused discussions of specific issues. Breakout sessions are used to increase participant interaction regarding the issues most relevant to their functional areas.

Ideally, breakout sessions are facilitated by someone with both subject matter knowledge and facilitation experience. If this is not possible, it is more important to have a good facilitator who can keep the discussion on track than to have subject matter knowledge. Following breakout group discussions, the groups reconvene in a plenum session to present outcomes.

Appendix D3: Guidelines for a Tabletop Exercise

A tabletop exercise is like a problem-solving or brainstorming session. A tabletop is usually not as tightly structured as a full-scale exercise, so problem statements can be handled in various ways. The facilitator can verbally present general problems, which are then discussed one at a time by the group or they can be verbally addressed to individuals first and then opened to the group.

Another approach is to deliver pre-scripted messages to players. The facilitator presents them, one at a time, to individual participants. The group then discusses the issues raised by the message, using the Emergency Operating Plan or other operating plan for guidance. The group determines what, if any, additional information is needed and requests that information. They may take some action if appropriate.

A third option is for players receiving messages to handle them individually, making a decision for the organization they represent. Players then work together, seeking out information and coordinating decisions with each other.

Participants should be provided with reference materials that could include EAPs, maps, and other relevant materials. The tabletop facilitator must have good communication skills and be well informed on applicable plans and organizational responsibilities.

Appendix D4: Guidelines for Games

Games are hypothetical situations steered by player actions. Games explore the consequences of player decisions and actions. Therefore, they are excellent tools to use when validating or reinforcing plans and procedures, or evaluating resource requirements.

Games have the following common characteristics.

- Play unfolds contingent on player decisions.
- They encourage a competitive environment.
- They provide rapid feedback.
- They improve teamwork.
- They foster an environment to practice group problem solving.
- Group message interpretation is tested.
- Interagency coordination is assessed.
- Senior officials become familiar with individual responsibilities.
- Players explore potential future scenarios.
- Consequences of player actions are demonstrated.

A major variable in games is whether consequences of player actions are scripted or random. After each player action or move, the controller presents the outcome. Depending on the game's design, this outcome can be either pre-scripted or decided after play. Identifying critical decision-making points is a major factor in the success of games because players make their evaluated moves at these crucial points.

Due to the usual limitation on number of players, planners are encouraged to open the exercise to observers, if possible. Observers are asked not to participate in discussions and strategy sessions, but can be tasked to make notes and report back to controllers with feedback.

Appendix D5: Guidelines for Drills

A drill is a coordinated, supervised activity usually used to validate a specific operation or function in a single agency or organization. A drill is useful as a stand-alone tool, but a series of drills can also be used to prepare several agencies/organizations to collaborate in a full-scale exercise.

Drills typically include the following attributes.

- They have a narrow focus.
- Results from drills are measured against established standards.
- They provide instant feedback.
- They involve a realistic environment.
- They are performed in isolation.
- Players become prepared for exercises that are larger in scope.

Clearly defined plans, policies, and procedures need to be in place. Personnel need to be familiar with those plans and policies, and trained in the processes and procedures to be drilled.

The drill begins when controllers and evaluators are properly stationed. If no safety issues arise, the drill continues until the process is complete, time expires, or objectives are achieved.

During the simulated incident, players must know that they are participating in a drill and not an actual emergency. Controllers ensure that participant behavior remains within predefined boundaries and that entities not involved in the drill (e.g., site security, local law enforcement) are not unnecessarily mobilized.

Evaluators observe behaviors and compare them against established plans, policies, procedures, and standard practices (if applicable). Safety controllers ensure all activity takes place within a safe environment.

Appendix D6: Guidelines for Functional Exercises

The functional exercise makes it possible to test the same functions and responses as would be tested in a full-scale exercise, without the high costs or safety risks. Functional exercises are lengthy and complex; they require careful scripting and careful planning.

The functional exercise is well-suited to assess the following attributes.

- Direction and control of emergency management;
- Adequacy of plans, policies, procedures, and roles of individual or multiple functions;
- Individual and system performance;
- Decision-making process;
- Communication and information sharing among organizations;
- Allocation of resources and personnel; and
- Overall adequacy of resources to meet the emergency situation.

The exercise is much more likely to be successful if the participants receive a briefing that covers an overview of objectives, how the exercise will be carried out, the time period to be simulated, and ground rules and procedures. The exercise formally begins with the presentation of the narrative.

The action begins as simulators communicate messages to players, and players respond as they would in a real emergency. The players then make requests of simulators, and simulators react convincingly. This ongoing exchange takes place according to the carefully sequenced scenario of events that governs what takes place, when each event occurs, and the messages used to inform the players. The players should be able to decide among the full range of responses normally available to them during an emergency. Their ability to make decisions, communicate, or otherwise carry out their responsibilities should not be constrained by the exercise situation.

Functional exercises can depict events and situations that would actually occur over an extended time period (one or two weeks or more). In order to include multiple phases of the emergency (preparation, response, recovery, mitigation) in a two-day exercise, it would be necessary to stop the exercise periodically and advance the time by a number of hours or days. These skip-time transitions should be kept to the minimum necessary to cover the scope of the exercise. They can usually be planned to coincide with a natural break point.

To the extent possible, the functional exercise should take place in the same facility and in the same operational configuration that would occur in a real emergency.

Appendix D7: Guidelines for Full-Scale Exercises

Full-scale exercises are interactive exercises designed to challenge the system under review in a highly realistic and stressful environment. The realism of the full-scale exercise can be conveyed through on-scene actions and decisions, simulated "victims," communication devices, equipment deployment, and resource and personnel allocation.

Full-scale exercises require a significant investment of planning, time, effort, and resources-it may take 1 to 1 1/2 years to develop a complete exercise package. Despite the intensive effort involved in the planning and implementation phases, full-scale exercises are valuable because they enable an organization to evaluate its ability to perform many functions at once. They are also effective at pinpointing resource and personnel capabilities, revealing planning and resource shortfalls, and testing inter- and intra-organizational coordination.

The full-scale exercise begins in a fashion similar to the functional exercise; whether it is announced or "no notice" depends in part on the objectives. The exercise designer will decide how and when the exercise is to begin. The trigger may simply be a call from dispatch, a radio broadcast, or a telephone call from a private citizen. The beginning for each participant should be as realistic as possible (that is, personnel should receive notification through normal channels).

All decisions and actions by players occur in real time and generate real responses and consequences from other players. The exercise messages may be scripted or use visual-staged scenes, props, or role-playing victims.

Because the activity during the exercise is at a very high level, great care must be given to developing, implementing, and monitoring health and safety plans. The high level of activity also suggests that multiple observers must be on hand to record and assess decisions, outcomes, conflicts, resource use, and the effectiveness of the plans or protocols being tested.

Appendix E: Potential Crisis Management Incidents

The following are examples of the types of incidents that could serve as the basis for developing an emergency action plan, a recovery plan, and a continuity plan, as well as an exercise to test the effectiveness of those plans.

Attack: A hostile (cyber or physical) action aimed at disrupting or destroying operational capability and/or causing significant damage to the facility.

Breach or Failure: Any condition characterized by total or partial loss of the capability to impound water.

Controlled Breach: Planned (non-emergency) breach of an impounding structure, possibly carried out to remove the facility from service or to make major repairs.

Cybersecurity Incident: Any denial of service attacks incidents, identification of malicious codes, unauthorized access, and/or inappropriate usage of information systems.

Earthquake: Operations and structural performance are affected by a nearby seismic event.

Emergency Action Plan Activation: Implementation of the emergency action plan (or emergency actions) in part or whole.

Emergency Condition: Any event or circumstance that clearly compromises the structural integrity of the facility and could lead to breach or failure. For example: Water has overtopped a dam or dike.

Equipment Malfunction: Failure of mechanical or electrical equipment to perform the functions for which they were intended.

Excessive Release: Reservoir discharge that exceeds downstream capacity and/or causes downstream damage.

Facility Mis-operation: Unintentional operator error affecting the operations of the facility.

Lock Closure: Unscheduled or scheduled interruption of partial or total navigation traffic through the facility.

Physical Security Incident: Any breach in access control systems such as fences, doors, gates, locks, and security zones.

Regulatory Action: The regulatory agency has determined an unsafe condition exists, or that the facility does not meet applicable design criteria (e.g., inadequate spillway capacity), and requires action to be taken by the owner (e.g., reservoir restriction, safety modification).

Reservoir Incident: Any event in the reservoir that may impact the structural/functional integrity of the facility. For example: Landslides.

Sabotage: A deliberate action aimed at weakening or destroying operational capability through subversion, obstruction, disruption, and/or destruction.

Security Posture Modification: Any change of security activities and protocols in response to specific threat reports.

Significant Inflow Flood: Operations and structural performance are affected by significant inflow flood.

Significant Inflow of Ice and Debris: Operations and structural performance are affected by significant inflow of ice and debris.

Structural Modification: Modifications to improve the safety and/or operational characteristics of the facility.

Suspicious Activity: Any indication that surveillance activity (such as elicitation of inappropriate information, suspicious photography, attempted intrusion, steady observation, etc.) could be taking place.

Unsafe Condition: Any developing or occurring event or circumstance that may adversely affect the structural integrity of the facility but that is considered controllable through the appropriate remedial actions. For example: Water level of the reservoir reaching unsafe levels; any developing downstream erosion or settlement; any unusual leakage; etc.

Unsatisfactory Condition Report: The findings of any inspection, assessment, or investigation that identify unsatisfactory or unsafe conditions at the facility.

Unusual Observation: An unusual situation is detected but there is no indication that the structural/functional integrity of the facility may be immediately compromised. For example: Observations of damage, deterioration or signs of distress; instrumentation readings reaching pre-determined limits; signs of piping, slumping, unusual cracks, or sinkholes; any obstruction in the spillway; etc.

Vandalism/Theft: Willful or malicious destruction or defacement of public or private property/ taking and removing of personal property with intent to deprive the rightful owner of it.

Vessel Allision/Collision/Grounding: Any events involving vessel impacts on other vessels, structures or operating equipment at the facility.

Appendix F: Dams Sector Coordinating Council

Allegheny Energy

Ameren Services Company

American Electric Power

Association of State Dam Safety Officials

AVISTA Utilities

CMS Energy

Dominion Resources

Duke Energy

Exelon Corporation

Hydro-Quebec

National Hydropower Association

National Mining Association (ex-officio member)

National Water Resources Association

New York Power Authority

Ontario Power Generation

Pacific Gas & Electric Company

PPL Corporation

Progress Energy

Public Utility District 1 of Chelan County, WA

Scana Corporation

South Carolina Public Service (Santee-Cooper)

Southern California Edison

Southern Company Generation

TransCanada

U.S. Society on Dams

Xcel Energy Corporation

Appendix G: Dams Sector Government Coordinating Council

Department of Agriculture—Natural Resources Conservation Service

Department of Defense—U.S. Army Corps of Engineers

Department of Homeland Security—Office of Infrastructure Protection; Federal Emergency Management Agency; U.S. Coast Guard

Department of the Interior—Bureau of Reclamation

Department of Labor—Mine Safety and Health Administration

Department of State—International Boundary and Water Commission

Federal Energy Regulatory Commission

Tennessee Valley Authority

Bonneville Power Administration

Western Area Power Administration

State governments—Represented by Dam Safety Offices of:

California

Colorado

Nebraska

New Jersey

Ohio

Pennsylvania

North Carolina

Washington

Appendix H: Acronyms and Abbreviations

AAR	after action report
CIKR	Critical Infrastructure and Key Resources
CIRT	Computer Incident Response Team
COOP	Continuity of Operations
CP	continuity plan
DHS	Department of Homeland Security
DSSP	Dams Sector-Specific Plan
DSO	Dam Safety Office
EAP	emergency action plan
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
GCC	Government Coordinating Council
GIS	geographic information systems
HSIN	Homeland Security Information Network
HSEEP	Homeland Security Exercise and Evaluation Program
HSPD	Homeland Security Presidential Directive
ICS	incident command system
IERP	internal emergency recovery plan
IT	information technology
JTTF	Joint Terrorism Task Force
MSEL	master scenario events list

NERC	North American Electric Reliability Corporation
NFPA	National Fire Protection Association
NID	National Inventory of Dams
NIMS	National Incident Management System
NIST	National Institute of Standards and Technology
NIPP	National Infrastructure Protection Plan
NRF	National Response Framework
PFMA	potential failure modes analysis
RP	recovery plan
SCADA	supervisory control and data acquisition
SCC	Sector Coordinating Council
SP	security plan
SSA	Sector-Specific Agency
TV	television
US-CERT	United States Computer Emergency Readiness Team
WMD	weapons of mass destruction

Appendix I: Bibliography

Dams Sector-Specific Plan. This document supports the National Infrastructure Protection Plan by establishing a sector-specific but coordinated approach to national priorities, goals, and requirements for critical infrastructure and key resources protection in the Dams Sector. Distribution information is available through *dams@dhs.gov*.

Emergency Action Planning for State Regulated High Hazard Potential Dams (FEMA 608). This document provides the findings, recommendations, and strategies of the National Dam Safety Review Board Task Group on Emergency Action Planning and Response for significantly increasing the number of emergency action plans for state-regulated, high hazard-potential dams. It can be obtained from FEMA in print or on CD, or can be viewed online at *http://www.fema.gov/library/viewRecord.do?id=3122*.

Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners (FEMA 64). The guidelines encourage strict safety standards in the practices and procedures used by Federal agencies or required of dam owners regulated by the Federal agencies; they address management practices and procedures but do not attempt to establish technical standards. The document can be obtained from FEMA in print or on CD, or can be viewed online at *http://www.fema.gov/plan/prevent/damfailure/fema64.shtm*.

Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams (FEMA 333). These guidelines are used in conjunction with FEMA 64 to define the types of dams for which an emergency action plan should be developed; they can be viewed online at *http://www.fema.gov/library/viewRecord.do?id=1830* or obtained in print or on CD from FEMA.

National Incident Management System (NIMS). This system provides a consistent nationwide template to enable Federal, State, local, tribal, and territorial governments, the private sector, and nongovernmental organizations to work together to prepare for, prevent, respond to, recover from, and mitigate the effects of incidents. Additional information is available at *http://www.fema.gov/emergency/nims/*.

National Infrastructure Protection Plan. The National Infrastructure Protection Plan (NIPP) and supporting Sector-Specific Plans (SSPs) provide a coordinated approach to critical infrastructure and key resources protection roles and responsibilities for Federal, State, local, tribal, territorial and private sector security partners. It is available at *http://www.dhs.gov/xprevprot/programs/editorial_0827.shtm#content*.

Standard on Disaster/Emergency Management and Business Continuity Programs (NFPA 1600). The 2007 version of standard 1600, developed by the National Fire Protection Association, provides a standardized basis for disaster and emergency management planning and business continuity programs in private and public sectors by providing common program elements, techniques, and processes. The standard is available at *http://www.nfpa.org/assets/files/pdf/nfpa1600.pdf*.

Homeland Security